Participatory online environmental education at the Open University UK

Book Section

Teaching Sustainability - towards curriculum greening

Volume 11 of the Series:
"Environmental Education, Communication and Sustainability"

Table of contents

Preface

The year 2002 is a special year. Ten years after the UN Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil in June 1992, the UN is holding a Sustainable Development Summit in Johannesburg which, among other things, will review the progress achieved since. Having organised one of the parallel sessions at UNCED (the International Workshop on Environmental Education) as part of the Global Forum, attended by over 80 colleagues from the five continents and having breathed the air at Flamengo Park where the Global Forum was held, I strongly feel that as part of the UN Sustainable Development Summit, other parallel events should be held so as to complement the official and often tedious, debates. Indeed, if the driving force of the Global Forum, namely the late William Lindner would be alive today, he would most likely have organised another similar event there.

It is therefore with great pleasure that, as part of a team led by Dr. Heila Lotz and colleagues, the conference on environmental management at sustainable universities or EMSU 2002, is being held in Grahamstown. The meeting is both, a follow up to EMSU 1999 held in Lund, Sweden and a parallel event to the UN Sustainable Development Summit. Indeed, it is the only of a set of events to take place in South Africa around the time of the Summit, to focus on the particularities of implementing sustainability at universities. It is therefore a great pleasure that this book, which will find its way to universities all over the world, can be launched at EMSU 2002.

It is now beyond any doubt that higher education institutions around the world are beginning to recognise that they have a unique responsibility towards the goal of sustainability. Universities are an integral part of the global economy and since they prepare most of the professionals who are occupying key positions today and who will do so in the future, they are uniquely positioned to influence the direction we choose to take as a society. As a matter of fact, some may even say that the success of higher education in the twenty-first century may be judged also by its ability to make sustainability a cornerstone of academic practice.

Acknowledgement of the unique responsibility carried by the higher education sector is reflected in the many declarations of commitment to sustainability signed by hundreds of universities worldwide: Bologna and Talloires, for example, have become common terms and are widely known. In addition, many other declarations of commitment have since been made by universities, including the Swansea Declaration (1993), the Kyoto Declaration (1993), the CRE Copernicus Charter (1993), the Student Declaration for a Sustainable Future and the

Earth Charter (1994), and, more recently, the Lüneburg Declaration (2001). More will no doubt follow as signs of self-reassurance that more action is needed.

As stated by a team at Melbourne University, who just produced an excellent sustainability report, joint declarations are just one mechanism by which Universities state their intentions to collaborate to develop sustainability on campus and beyond. Another tool is the formation of University consortia to develop mutual development and support mechanisms to implement sustainable practices. For example, a consortium of European and Latin American Universities are developing approaches to including sustainable development dimensions in their teaching programmes. The Technical University of Hamburg (Germany), the Royal Institute of Technology (Sweden), the University of Girona (Spain), the University of Sao Carlos (Brazil), University of Cuyo (Argentina) and University Autonoma de Mexico (Mexico) are working together on the project "Programme of curriculum greening on university studies". The scheme, funded by the ALFA programme of the European Union, runs from Sep 2001 to Sep 2003 and involves curriculum design and the execution of practical projects at each university, complemented by staff exchanges, and periodic summit meetings between participants to report on progress and to develop new strategies.

Moreover, key organisations have been established to assist with this type of coordinated effort, including the University Leaders for a Sustainable Future (ULSF), the Higher Education Network for Sustainability and the Environment, the Environmental Association for Universities and Colleges, the Australian Universities Environmental Managers Network and many others around the world.

International surveys and empirical works on sustainability have invariably recommended action in the fields of curriculum, operations, training and research. This book is concerned with the first area: curriculum. Via the descriptions of approaches, methods and projects, it shows how different universities in various parts of the works are facing the challenge of sustainability in respect of teaching. Its case study approach means that a special emphasis is given to practice - as opposed to a focus on the theory as has largely been the case in the past- and shows what can be achieved and, as importantly, how.

I am proud of this book and proud of the work developed by the various authors, who are from countries as varied as Brazil, Mexico, Latvia, South Africa, UK, Spain, The Netherlands, Canada and the United States. To all of them, a sincere word of thanks. Thanks are also due to ULSF, for the support with the publication. It has to be acknowledged that ULSF has become central to international discussions and debates on aspects of sustainability in higher education and the hard work performed by Wynn Calder and Rick Clougston, together with their openness for new ideas and new concepts, is instrumental to its success. I cannot omit the help provided by Linda Döring and Olaf Gramkow, whose assistance has been vital to me as I hop from one course to the other and shuttle between countries. Kirsten, Martin, Fiona, Marianne, Hanna and Arnie must also be thanked for their patience and the long hours spent away from them working on the manuscripts. Whilst I thank all these great people, I gladly take the blame for any errors or omissions that could have been made here.

I hope this book will be a valuable tool for teaching and research staff as well as to students, who will find useful hints and advice on how to teach sustainability, bearing in mind different contexts, realities and resources.

Professor Walter Leal Filho (PhD, DSc, DL)
Hamburg, Summer 2002

Chapter 7: **Participatory online environmental education at the Open University UK**

***Author*: Dr Sandrine Simon**

Lecturer in Environmental Systems
Open University, Centre for Complexity and Change. Walton Hall, Milton Keynes. MK7 6AA.
e-mail: s.m.simon@open.ac.uk

Abstract:

The role of education in helping our societies put sustainability into practice is crucial. The motivation, awareness and empowerment, necessary for citizens to understand the concept and take part in its operationalisation, ought to *emerge* from environmental education, since we might encounter some difficulty when trying to *teach, or impose* these notions in a theoretical way. In developing environmental courses, we therefore ought to progressively replace pedagogical approaches based on (relatively 'authoritarian') *transfers of information* with more *interactive and collaborative learning processes:* citizens' participation can start with the creation of communities of learners.
This paper describes the construction of two web courses: a first level teaching module on *environmental systems* and a third level *interdisciplinary environmental* course, both developed at the Open University, specialised in distance and open learning. The themes of the course include participatory processes in decision-making, the perception and representation of environmental systems, alternative leadership, biodiversity, climate change and integrated water management, environmental action and governance. The concepts focused on include sustainability, complexity, uncertainty, globalisation and 'systemic problem solving'.
In both courses, the overall pedagogical process is based on the notion of environmental governance. This means that the web has been chosen as a learning platform, because

- it provides various types of up to date information as well as archives,
- it allows various types of users to communicate between different countries, and also
- it encourages collaborative and interactive learning.

This paper describes the experience of the author in creating web environmental courses at the Open University. Components of the courses such as interactive activities are discussed, as well as the pedagogical focus progressively shifted towards more participatory processes of learning.

INTRODUCTION

One of the most remarkable outcomes of debates on sustainability, out of the last twenty years, might well have been the emergence of notions such as 'capacity building'[1] and 'participatory processes'[2]. This seems to have resulted from a context in which research on sustainability evolved

- from being focused on environmental/ ecological concerns - and aimed at helping us understand better how ecosystems function in order to improve the way in which we interact with nature-,
- to being focused on economic considerations - and aimed at integrating our new understanding of environmental functioning in our economic practices.

Relatively recently, debates on sustainability started integrating *social and cultural dimensions* in various ways, and this helped us in grasping some important practical dimensions of sustainability.
For instance, in the context of capacity building and participatory processes,

- The notion of 'experts' is now being questioned and the views and interests of local communities are now better valued and integrated in the analysis of any project 'aimed at improving the environmental situation'.
- Exchanges of practical knowledge between various stakeholders is also valued and viewed as a necessary complement to more theoretical principles concerning sustainability.
- Conflicting views, interests and objectives concerning potential environmental projects are no longer perceived as negative. Rather, mapping these views and formulating ways to build trade-offs helps identify the abundance of aspirations that contribute to defining sustainability in all its dimensions.
- Allowing and encouraging everybody to take part in environmental debates (through citizens juries, for instance) and actions (participatory projects) that include non-experts proves to not only considerably improve environmental awareness, but also to empower a variety of stakeholders who are hence more motivated to get involved in environmental actions - that they care for.

---

[1] Capacity building is the term used to describe the necessary process of institutional expansion, improvement or reform, which facilitates the effective operation of programmes or services. The process should be continuous, and applies as much to formal bodies as informal bodies, such as local community groups. The concept of capacity building has become very prominent in development thinking during the recent past. (EU, 1998:211)

[2] Participation is understood to mean a process by which people share in decisions relating to policies and actions undertaken by formal bodies on their behalf, and by which they accept responsibility for those decisions. A participatory approach is often one which leads to project beneficiaries becoming actors or managers within a service delivery scheme. (EU, 1998:217)

In practice, and more often than not, you will have come across terms such as participation and capacity building in the context of environmental NGOs' discourse and projects, Agenda 21, etc.
However, these terms seem to be less well-integrated in educational debates, although environmental education is also highly promoted as a way to highlight the social dimension of sustainability.

In this paper, we are interested in investigating ways to make a long-awaited marriage between the two happen: i.e. What does participation of stakeholders and capacity building involve in the context of environmental education and how can we create environmental education systems that can contribute to operationalising sustainability?

This chapter examines how web courses, in particular, can help answer these two questions.
The environmental web courses we will focus on here are courses from the UK Open University, well known for its innovative and creative approaches to open supported distance learning.
In a first part, I concentrate on the themes covered by these courses and the reasons why, in my view, they relate to the issues previously mentioned in this introduction.
In a second part, I focus on the students' approach of the courses and on the learning outcomes and new skills acquired.
Finally, I conclude on what types of new pedagogical dimensions need to be highlighted and developed when constructing a web environmental course.

PART I. A new set of *sustainability themes* for environmental courses?

This part focuses on what people want to know about sustainability, what people care about and are interested in and, as a consequence, how the set of *sustainability themes* we tend to teach would benefit from being reviewed.
In this part, we examine these point in the context of environmental education and what has typically been taught in the context of environmental education on sustainability; we also explain new tendencies and needs in environmental education.
We then focus more specifically on the approach adopted in two environmental courses: T205[3] (teaching block 3 on environmental systems) and U316[4].

I.2. Sustainability themes in environmental education

In agreement with the evolution of research and debates on sustainability, environmental courses evolved from being very disciplinary orientated (environmental science, or environmental politics, or environmental econometrics, etc.) to being progressively more interdisciplinary. In addition, one can notice a move from theoretical considerations (various conceptual definitions of sustainability - strong and weak, and other distinctions, for instance -, various classifications of theories - technocentrists, deep ecologists, etc.-) to more practical concerns. It is now more common to see environmental courses focus on *environmental policy-making*, for instance, or on approaches that cover various disciplinary perspectives and focus mainly on environmental action, as is the case in *'institutional economics'*, for instance.
What emerges from this is the fact that, whether you represent the European Union, or a local authority, or whether you are a student keen to learn about sustainability and environmental debates, you will be more aware of environmental 'key terms' (such as sustainability, environmental auditing, environmental impacts…) than you would have been, let us say, ten years ago. The debates seem to have progressively moved from a specifically environmentalist audience and reached a **broader audience**.

People who decide to take a course on environmental issues therefore need to both go beyond the simplistic environmental arguments presented by the media - which requires a rigorous up to date presentation of environmental thinking and main theories - and take a first step in examining issues that are of current concern, such as the *'operationalisation of sustainability'*. How to put complex and conceptual notions such as 'sustainability' into practice has really become *the* starting point question[5]. If we start by examining an environmental problem, solving it in view of managing a resource more sustainably now involves taking account of various stakeholders views, interests and knowledge and building on approaches suggested from various disciplinary perspectives. This implies that we are now prepared to use the huge baggage in environmental knowledge that has been built since the end of

[3] http://www.open.ac.uk/technology/t205/
[4] http://www3.open.ac.uk/courses/bin/p12.dll?C01U316_environment
[5] This resulted, for instance, in very active research activities on indicators of sustainability and other policy tools, in the 1990s.

the seventies in order to progressively *develop a learning platform* aimed at identifying the prerequisites for, and ways of, putting sustainability into practice.
Focusing on the **practical dimensions of sustainability**, themselves directly linked to decision and policy making, as well as **participatory processes**, can therefore build on the theoretical and more conceptual approaches of the same issues. But the emphasis is now on **environmental action** and on who can act and have an impact on environmental improvements, and how.

This leads us to discussing another issue that is of prime interests for people who are keen to take environmental courses. If various stakeholders can take part in environmental action, how am *I* supposed to do so, where do *I* start? Creating environmental awareness and motivation has to start with **empowering people** and allowing them to express themselves on these issues and exchange views in a more open learning arena.
More and more, environmental courses include a *project*, of which the students will be in charge, and which contributes to him/her expressing him/herself and 'learning by doing' ('engagement theory').

The learning context is therefore crucial: can we really *'teach sustainability'* to an audience of students, or do we need to *facilitate a learning process* to identity what each of us understand about sustainability and how we can each contribute to its operationalisation? Recent debates on the social dimensions of sustainability show that this concept is partly *socially constructed* and the idea of transferring knowledge and definitions on such a term therefore seems nearly paradoxical. In this chapter, I take the view that a **social learning process** is needed: although some key characteristics of sustainability (described for decades by people working on this concept) can be identified, they might be better understood by the students if they *emerge* from a discussion that includes in some way their experience. **Social learning**[6] is high on the environmental research agenda and it gives us a critical opportunity to question the way in which we organise 'environmental education' at university and elsewhere.

A concern that has been existing for quite a while in environmental education is the '**inter-disciplinarity** issue'. Organising interdisciplinary courses has not been easy, and often still isn't. But progress is being made and, to some extent, the development of web courses might help in this direction, since links and references to other courses or disciplinary perspective on an issue can be made easily, while by-passing the politics and difficulty of putting together a team of people from different faculties and discipline to write a course together. Having said that, academics now seem keener to stress the inter-disciplinarity of environmental issues, and some progress is being made in developing environmental interdisciplinary courses, despite the inadequacy of the university institutional setting to do so. Whether students are keen to follow environmental courses from an interdisciplinary perspective is another matter - they might be terrified at the idea of having to catch up with all the basics from disciplines they never familiarised with or never intended to study. The handling and pitching of the level of the students in each discipline has therefore to be handled very carefully. Here again, using an environmental *problem* as a *starting point* might help in introducing the various disciplinary perspectives as well as the need for them, rather than starting with allowing the students to catch up with the basics of each discipline first.

Finally, and not least importantly, if one can show that environmental issues are very **contemporary** and a crucial component of our modern world, there is still some work to do in order to show that approaches adopted to think about and deal with environmental issues - as well as to teach them - are up to date and forward looking, as opposed to old fashioned and conservative. Progress has been made in this direction. Thus, environmental issues are more and more integrated in a business context for instance (environmental consultancy, environmental auditing, etc.) or in the context of eco-design (with the use of modern or ancient technologies and the emphasis on the modern, ingenious, outcome), or in relation to modern politics and international relations (environmental security, environmental conflicts resolution and negotiation techniques, etc.). At the Open University, environmental courses are keeping up with the quasi race being observed in developing web-courses, which also contributes to positioning environmental issues and education at the forefront. The 'authenticity'[7] of web environmental courses is one of their most important characteristics from a social perspective.
It is on two web OU environmental courses, and on the sustainability themes they focus on, that the next section focuses.

---

[6] Woodhill (1998) defines social learning processes as 'processes by which society democratically adapts its core institutions to cope with social and ecological changes in ways that will optimise the collective well-being of current and future generations'. Social learning provides a framework for thinking about the knowledge processes that underlie societal adaptation and innovation. Maarleveld and Dangbegnon (1999) explain that 'the notion of learning reflects the link between understanding and action necessary to cope with Natural Resources Management dilemmas, i.e. continuously developing both knowledge and the ability to us it. Because the learning concerns NRM dilemmas arising from the interplay of aggregates of individuals and their environment and because the resolution of these dilemmas entails collective action, it is characterised as social-environmental learning'. Both references are mentioned in Jiggins J. and Roling, N. (1999)

[7] Because students can access actual databases, experts, and reports of ongoing projects and practical initiatives, their learning activities, in web environmental courses, are *realistic*. One of the reasons that students often give for disillusionment with more theoretical environmental courses is the lack of current, *real world relevance*.

I.2. Do certain sustainability themes fit particularly well web environmental courses? The experience of T205 and U316 at the OU.

All the themes previously listed can be perfectly integrated in an environmental course. Certain themes however, seem particularly well adapted to *web* teaching, as showed below through the example of two OU web environmental courses.

The T205 experience

T205 is a 2nd level web course on Systems Thinking and Practice[8]. T205 uses a main 'web zone' as a guide to the students' learning journey: it is in the web zone that the narrative is concentrated and makes sense of how to use the other types of materials in the course such as printed texts, videos, audio cassettes, CD-ROM, and other web sites. It is also in the main web zone that a map of the course is given: a diagram represents the various teaching blocks and many hyperlinks refer to the list of material needed for each teaching session, or what is left to be done, etc. The student always knows where she/he is in the course and when there will be off line or online activities to be concentrating on. It is in the web zone that animated diagrams can be used to explain complex issues in another way than by using a lot of text to be read on screen. It is also from the web zone that students work on interactive activities, and from there that online conferencing takes place.
T205 is being taught for the second time this year (2002).
T205 is not an environmental course per se. However, a whole teaching module in T205 uses environmental systems and participatory policy processes as a way to illustrate how systems thinking can be used to help us understand and perceive an issue in a more holistic way and how systems practice can help find solutions to a complex problem.

Not surprisingly, such a subject of interest ('Systems[9]') is interdisciplinary. Adopting a systems approach has proved to help many authors understand better the concept of sustainability and to suggest ways of dealing with the complexity of the concept in the policy context -Clayton and Radcliffe, 1997, for instance, give an interesting view of sustainability, from a systemic perspective, as explained in the frame below. The interdependence between various issues is highlighted through systems thinking. In addition, the notions of complexity and systems boundaries are also examined. Thus, the scale at which sustainability ought to be considered has to be discussed, both in terms of time and of space.

Systems thinking and sustainability - "The question of sustainability affects all areas of human activity. The range of literature relevant to the subject is now extremely large, and many definitions of sustainability are now in use - some incompatible. Many indicators of sustainability, publications, methods, are extremely pertinent but disparate and *often fail to connect to any underlying analysis that could link these suggestions together in a coherent rationale and programme for change*. (…) A multidisciplinary approach is necessary to understand the extensive and complex ramifications of sustainability - although specialists often resist comments from outside their discipline, arguing that non-specialists cannot fully understand the complexity of the issues (page xiii). (…) Systems thinking provides a unifying analytical and explanatory framework throughout the complexity of nature. It provides a tool for integrating the contributions of different disciplines. It entails considering the various agents interacting in the world as systems. This approach invokes general principles concerning systems to make inferences about likely and actual interactions between the systems under consideration. These principles can also be used to analyse the observed patterns of interactions between systems (Clayton and Radcliffe, 1997:17)".

In the T205 teaching module focused on environmental systems, the learning experience focuses on how systems thinking and practice can help in **perceiving** and **defining an environmental problem** in a more holistic way, as well as **representing the issue in a systemic way** in view of communicating with the stakeholders who will make a decision on how to act in view of improving the situation. Thus, *systems diagramming techniques* are being taught - influence diagrams and multiple cause diagrams. Such diagrams help in understanding an environmental issue from various perspectives and to visualise what is happening and characterises a situation all at once. Teaching

[8] http://www5.open.ac.uk/t205demo/public

[9] **Systems definitions:** "A basic notion of the system concept can be found in Aristotle's observation that 'the whole is more than the sum of its parts'. Nowadays, a system is generally defined as 'a coherent whole of interacting entities'. A central idea in systems theory is that some system properties cannot be inferred from the individual properties of the constituting entities, but emerge only at the system level. Through its holistic nature, systems theory typically responds to the quest for an integrated approach as formulated in the environmental sciences" (Hoekstra, A.Y. (1998: 16).

diagramming techniques can be particularly well done through using *animation packages*[10] and added voice comments, showing the various stages through the construction of a system diagram. Ideally, synchronous audiographic[11] tutorials could also be used to teach systems diagramming techniques to a group of students.

A very strong emphasis is put, in this teaching block, on group work and on the need for stakeholders' **participation in environmental decision and policy-making.**
The **group work dimension** can take place in the context of *systems diagramming*, as we previously saw, but also in the context of *role-playing*. In T205, such an activity was organised in the context of debates taking place on controversial issues for which, typically, different groups of stakeholders will have different views and preferred course of action. Web courses can constitute a good platform in which to organise such activities, linking various learners from different areas and backgrounds.

Another strong emphasis, in relation to participatory processes, was put on institutional platforms that allow such processes to take place, as well as on alternative leadership (where the emphasis is put on facilitation rather than imposition on views or directions) and collaborative and interactive work. These issues are particularly well suited to web learning and teaching since, as we will see later in more detail, the collective 'social' learning process can take place in web courses through monitored collaborative web activities in which students are invited to express their views as well as share their experiences on a particular issue. 'Teaching participatory processes' can best be done through allowing such a *process* to happen in the context of the course, in the first place.

The U316 experience

U316 is a web interdisciplinary environmental 3rd level course. Various environmental themes are being taught in 4 teaching blocks - environmental information and the web, Antarctica, biodiversity, climate change, and water management. All the teaching blocks put a strong emphasis on the concept of sustainability, the notions of complexity, uncertainty, scales, globalisation and governance, and all adopt a problem solving approach. There is also a project that the students are in charge of. A lot of the teaching is done through text and CD ROM (videos, animations…) but most of it is done through the numerous web activities in which most of the creativity of the course production team is going. Various types of web exercises are being used (drawing packages to concentrate on systems diagrams; dragging suggested answers and matching them to questions; mapping and roll on facilities which allow to see a text appear when placing the arrow of the cursor on parts of the map; animations; etc.).
U316 will start being 'presented' (taught) in 2003 and is still in the process of being produced.

Like in the case of T205, and all other courses at the OU, the students audience for this course is very broad and include people from all ages and backgrounds. A set of prerequisites concerning a minimum level in a few disciplines and in computer literacy has been defined, but the design of the course is such than thorough help and guidance is provided through the acclimatisation period to the new web tools as well as to the inter-disciplinarity of the course. We will come back to this later when examining how to best teach online. For now, what I want to emphasise is the fact that, U316 is an environmental web course designed to interest **people from various disciplines and background**s, and primarily interested in environmental action and how various stakeholders can take part in environmental decision-making and 'governance'.

The issue of participation, in U316, is therefore included in the notion **of 'environmental action and governance'**, which is a big theme of the course, if not the main one.
Working towards effective environmental governance requires creating an enabling and empowering environment, as well as appropriate institutional and financial structures that can allow stakeholders to work together for effective environmental management. Throughout the course, a selection of recent case studies concentrates on such issues and demonstrates how environmental participation and action can take place. Students also progressively discover what environmental governance and participation means and what shape it can take by working on various web searches and other interactive activities.

In line with the idea of environmental action and governance, the development of **co-operative, collaborative and interactive work** is, of course, core to this web course. Not only these notions are examined in the context of

[10] Animation packages such as Flash are easy to use and allow to effectively create a cartoon with drawing, writing and voice. Various pictures follow each other, either automatically or by locating the cursor on a 'button' on the picture, which allows to move from one picture/text to another.
[11] These allow a group of people to communicate by writing a text message to each other or talking to each other while working on a same document on screen. A blank 'drawing board' allows people to write or draw elements of a diagram, for instance. A document (text, diagram, part of a web site…) can also be imported in this blank page and inscriptions can be written in its margin by all members of the group, or else, a monitored voice dialogue can take place. Students expressed a preference for group work when working on systems diagrams, and such facilities very much help in doing so.

environmental partnerships, for instance, but they are also directly implemented through group activities. These introduce the students to a set of skills and learning outcomes that emerge from such activities and can help in understanding better the conceptual and practical implications of operationalising sustainability.

I mentioned earlier that it is an **interdisciplinary** course and, indeed, the team includes authors from a biological, geography, political, technology and ecological economics backgrounds. For instance, by the end of the course, students should be able to understand better scientific information and environmental modelling, as well as political concerns on environmental issues, or how both ecosystems and human societies depend and potentially compete for using a specific natural resource.

Interdependencies between issues are also an important dimension of the course, directly related to its inter-disciplinarity, although not only. We are keen to examine the various dimensions of, and the various stakeholders involved in an 'environmental problem'. This is in view of highlighting the fact that understanding in which ways these are linked and inter-related might help in formulating the most effective solution or 'plan for improvement'. The systemic understanding and description of a perceived problem can therefore be addressed collectively, in view of identifying a solution that is respectful of the boundaries of the system we are considering.
Various collective activities (role playing, web searches on the various dimensions of an issue, etc.) as well as the work expected from the students in their project, very much evolve around the notion of a network of dimensions, causes and effects on a specific issue, in parallel with the network of stakeholders involved.
Therefore, the issue of governance, in the context of communication and collaboration through the web, is key to the course - although certain blocks focus more on it than others[12].

The **authenticity** dimension of the course is also crucial to the way in which it immerses students in a learning experience aimed at examining what sustainability means from a conceptual and practical perspective. We are very keen to make the students sensitive to issues related to sustainability through working collectively on recent case studies and collective collaborative work, rather than somehow 'imposing' a definition of *'what sustainability is or is not'*.
The themes we focused on are still very topical - water, for instance, is seen as one of the key environmental concerns for the 21st century and will be, together with energy, one of the key issues at the top of Rio +10 agenda (Earth Summit 2002).
The sources of information used in U316 also reflects the authenticity of the course, in that they come from maintained web sites and news groups, as well as recently published environmental reviews, and include e-mail communications both with environmental experts and a group of students from another country[13].

Finally, a main underlying theme of the course, also critical to people's attitude towards learning about environmental issues and sustainability, deals with learning to be an independent thinker, to have a critical mind, and to be able to evaluate critically both the material found on the web and pieces of work done by students' peers when they work in group. These issues will be presented in more details in the next section, which focuses on the learning outcomes and skills that we expect students to progressively acquire throughout these web courses.

Part II. Web environmental courses - new skills and learning outcomes

In this part, we concentrate on examining why it is relevant for students to acquire certain new skills and learning outcomes if they are to familiarise themselves with web learning platforms for

- communicating and collaborating as well as for
- understanding sustainability from a more holistic perspective and move towards its operationalisation.

Key words: Autonomy of the learners; Community of distance learners; Critical minds; Working in groups; Negotiating; Presenting one's work; Interactivity and collaboration; computer literacy.

II.1. Learning to be a successful web learner - general considerations

[12] The teaching block on water examines how certain web pages are designed to meet such an objective (such as the one launched by the Water Environment Federation together with leading international water organisations and companies in view of combining insights from thousands of specialists on water problems and of creating various partnerships and water projects).
[13] The plan is to be connected to a group of Californian students working on water management and to exchange views and information on the issue (both concerning California and the UK)

Learning through web courses provides the student with a great deal of **autonomy**. He/she can decide when, where, and how to learn.
This autonomy implies that the students learn how to self evaluate themselves and to be realistic about what they need in order to be successful e-learners. Not everybody is well suited for distance web learning. Thus, some people might be uncomfortable with written communication, for instance, or else, might find it difficult to work independently and to manage time effectively. Web courses therefore need to help students progressively link autonomy and responsibility by **teaching students to be better learners** (teaching skills such as time management, goal setting, as well as self-evaluation).
Often, people who are well suited to distance learning hesitate when it comes to following a web course because they feel they are computer illiterate. A characteristic of web courses is that they all provide help with this. Beside, many countries have now made improving the **computer literacy** of their population a national priority (e.g. in Finland, the government developed a 'computer driver's license'!). But these new policies do, generally, favour young citizens, leaving older ones with a handicap. It is for this reason that web courses always provide a help desk as well as clear and user friendly instructions on how to proceed with any learning web experience. This includes teaching how to use software effectively, how to conduct online searches, and how to use communication capabilities, for instance. Acquiring a certain level of computer literacy also implies that student learn how to familiarise themselves with the '**Netiquette**' - i.e. the conventions, or 'specific communications behaviour' that characterise the interactions with others online.
One characteristic of web learning is that **information change quickly**. Online learners must therefore become adept at modifying the way in which they learn in order to match these changes.
Two other dimensions of web courses characterise typical web learning outcomes and skills.
The first one deals with the fact that online learning is as much a social activity as an individual one and therefore **social skills** are an important aspect of online learning. In addition, interestingly, and as explained by Kearsley (2000), the social milieu of online activities is quite different from other types of personal interactions and therefore requires new skills and behaviour. Thus, asynchronous activities allow people to take as much time as they want to read and compose messages, which compensates for shyness or limited communication skills. As a consequence, extended online interaction seems to develop its own patterns of social behaviour.
The second one relates to what is now currently called **'engagement theory'**. This theory suggests that one main learning outcome and skills that ought to emerge from the learning processes that takes place in the context of a web course should be the ability of the learner to actively engage himself/herself in meaningful tasks for effective learning to occur. This means that students should be designing, planning, problem solving, evaluating, making decisions, or being involved in discussions. A Kearsley explains, 'Engagement theory defends the fact that students should be able to create their own learning environment. It also embraces the idea of situated learning which emphasises the importance of a community of practice, the experiential aspect of learning and the ideas of co-operative and team learning'.

In the next section, we will observe which other, or complementary, learning outcomes and skills have emerged from the two web OU environmental courses this chapter is focusing on.

II.2. Implementation in the context of the two OU courses

Web skills
In both courses, the students first had to learn how to work on the web and, by the end of the course, they ought to have acquired the following minimum set of skills:
- Use a search engine to gain access to the topic areas
- Read web pages and follow their links
- Subscribe to newsgroup or list-serves that relate to the topic
- Participate in chat rooms with a topical theme
- Exchange e-mail with individuals who appear knowledgeable in the topic
- Reporting on a web search, communicating one's views and expressing oneself on the web (using text or, for instance, drawing systems diagrams)
- Familiarity with multi-sensory learning styles; auditory learners need to hear the lessons; visual learners need to picture concepts.

Deriving learning outcomes through using the web
The way in which students learn and improve their knowledge of environmental issues will hopefully be considerably improved by the use of this series of web skills to acquire this knowledge. Thus, by the end of their course, students should have experienced the following:
- Reflecting learning process:

This involves observing your own thinking, feeling and acting. In T205, and in the context of a 'mess analysis' (typically used in systems thinking), a 'reflecting phase' follows 'sensing/perceiving', 'understanding and

representing', and 'deciding' phases. Thus, in each teaching block, a whole session is focused on reflecting. Web activities in this session would typically include involving students in reflecting, critically analysing, and synthesising the outcome of his/her learning journey in his/her 'learning file', used later further steps along the learning journey. In U316, such a learning file will also exist, although it will probably be saved in a directory on the student's computer's drive. Self- Assessment Questions also allow reflecting to take place and web activities typically all include an SAQ (which can be presented as a QUIZ, a game, a vote, etc.). In the same web activity, the set of instruction will have started with putting the activity into context in the course, and will have finished with a summary of what has been learnt through the activity and how it helps the student in carrying on his/her learning journey. The contextualisation of a learning exercise is, in itself, part of a reflection process.

- Questioning one's assumptions

Having access to more information and also more views and opinions on a same issues allows one to improve one's knowledge on this issue as well as identify the fact that some views can be prejudiced. In U316 (teaching Block on water), a whole web activity concentrates on eliminating 'water prejudices' (or 'illiteracy', as described in the literature on water) by formulating some questions on water in California and carrying out a dialogue with the students who live in California. In T205, the questioning of one's assumption is taking place when working in groups on the representation of systems.

- Constructing knowledge involves critical analysis, dialogue, and reflection

Collaborative work and per reviews of each other's work, in U316, contributes greatly to constructing knowledge through these three 'critical ingredients'. The evaluation and critical commenting on some selected web material is also designed for students to learn how to construct knowledge in a web environment where information abounds but is not always of high quality.

- Conferencing in order to explore issues and discuss positions

Both in T205 and U316, the use of interactive facilities (called 'x-lets'- examined in the next paragraph) allow students to build on their experience and knowledge, that they are invited to share with other students. These are as crucial as the information provided by the web or the course author, in exploring issues and constructing knowledge.

- Development of a high level of competence in complex reasoning:

The problems to be solved are becoming more challenging, the decisions to be made are more complex, and the interdependencies in the global world are more intricate than ever before. In T205, although it is not presented as the unique systems analysis methodology, the learning and reflecting journey is structured through the 'mess analysis', itself constructed around four phases ('perceiving', 'understanding', 'deciding', 'reflecting and acting'). This can also help students in the research they might carry out on an issue on the web. In U316 (Block 4 on water), systems diagrams are used to structure the thinking about a complex issue as well as web searches on it. An emphasis is put on the inter-relations between issues throughout the course, as a characteristic of the complexity that surrounds environmental issues.

- Performance tasks ask the students to demonstrate their ability to use knowledge and skills:

Distance education programmes have found that the usual multiple choice or true/false tests is ineffective over the web. Therefore web activities are more performance based: this means that instead of regurgitating the material read, students are asked to perform the skills identified as learning outcomes. (For example, in a written communication class, the students will be required to write a real world business proposal in the context of their own work life, rather than simply discuss what should go into a proposal or identify the parts of a business proposal on a test).

Web communication skills

In both environmental web courses, a part from a standard *online asynchronous conference* facility, the students are also involved in interactive activities of three types. These are called *'X-lets'* and allow the students to:

a) exchange ideas: The *'ideas bank'* allows students to share their knowledge on an issue by allowing them to share ideas of illustrations of a point made in the course; a thread of discussions on different ideas is then created and visible by all students. The discussions can be viewed later in the course and are part of the learning experience and outcome of the students.
b) exchange views and impressions: the '*chatlets'* are the equivalent of a discussion between students in a live tutorial or after a course, in the corridor. They allow students to feel that they are part of a community of learners and to share their first impressions on a subject. These chatlet-discussions are also saved and can be viewed and recalled by all.
c) Vote: the '*votelets*' allow students to vote on an issue (quiz/ self assessment question/ game/ vote…). They can see what they others have voted only once they have voted themselves.

Within the teaching module we are referring to, the participation of a variety of citizens in the environmental decision-making process and the way to do so is the prime theme. Around this theme, group work (in particular on how to perceive an issue differently, and from a systemic perspective) is an issue that is well developed, as well as the mapping of a debate using Multi criteria analysis, and the acknowledgement that participatory processes include dealing with conflicting interests, objectives, and views.

In addition, in U316, most long-term learning is taking place through collaborative web activities - the design of which is therefore the most time consuming for the course production team. All web activities include various sections on:

- the description of the objective of the web activity,
- an introduction of the activity in the context of the learning (why do we need to concentrate on this activity here, what is it going to bring?)
- a set of instructions on how to proceed through the web exercise (each web activity is different - some might involve some web searches, some might involve the drawing of a systems diagram, some might involve the use of a simplified environmental model, or the retrieval of environmental data, etc.)
- a set of resources needed when doing the activity
- some space where the student can type his/her answer - and save it in his/her learning file, or send it to his/her AL.
- Some feedback on the answer (either standardised or personalised, but always needed and quite precise
- A summary of what has been done and learned and how it is going to help pursue the learning journey.

The importance of collaboration in general is also crucial: it means that there is interaction among students, teachers, associate lecturers and, potentially, subject matter experts via e-mail, discussion forums and conferencing.

Social learning

Individual learning outcomes and skills acquired through carrying out the course are, of course, very important. However, one needs to note that, in the context of a web course, the learning process is also highly collective and 'social learning' is taking place each time a collaborative interactive activity is being worked on. The basic idea behind social learning is that groups, communities, or organisations can collectively learn on the basis of shared perception of problems, their causes and solutions, and agreement on goals, to take concerted action.

The T205 teaching module on environmental systems focuses heavily on 'group work', both in terms of what it teaches (participation in environmental decision-making processes) and in the way in which it organises the learning journey of the students. A community of learner is progressively established throughout the course and people can have a real dialogue through the various x-lets. Although these are monitored to a certain extent (completely wrong suggestions should not appear in the thread of the discussion), students are free to express themselves. Different types of communication have resulted in different types of learning. For instance, the x-lets are kept very close to the issue being looked at in the course. The conference, on the other hand, has been used by students for all sorts of purposes, including discussions on how to organise their work (remember that OU students, most of the time, have a job, or a family, or are living in the middle of nowhere…) or on planning how and where to meet to work on an exercise between a few students of the same region. The conference has also been used by students to communicate with their ALs.

The richness of the learning experience of using the x-lets has been very much related to how well the exercise was organised. The design of the questions is crucial in motivating the students to participate to the debate or not, and putting the students on the 'right track' in terms of reflection on an issue. The richness of the learning experience is also increased if the students can go back to the discussion: i.e. re-read the discussion and use it in the context of another learning experience.

All that has been said in this paragraph is also true in the context of U316. In the context of U316, a further dimension of social learning is taking place through the process of peer-reviewing planned to take place between students. Students can help each other and learn from each other. They can also learn about themselves by observing more thoroughly the work of others.

The empowerment of non-experts

A skill learned by e-students is also to ask for help when needed: online instructors depend on students to inform them of their needs for guidance and advice.

OU courses are, by definition, open to any type of learner -although some prerequisite requirements are imposed for each course. The learning is also described as 'open and supported', at the OU. This means that students do have constant feedback on their work from their ALs (Associate Lecturers).

But more importantly, the design of OU courses is such than 'engagement theories' and 'emergent learning' are constantly at work: students learn by doing something (concentrating on an interactive web activity for instance) and learning outcome emerge from a whole set of learning experiences that *start with the students' knowledge and experience and values it*. The ideas banks described earlier are based on the idea of valuing students experience and relating these experiences to the context of the learning taking place in the course.

In their project, students concentrate on implementing a systems analysis of an issue and on illustrating how systems thinking and practice could help improving the originally problematic complex situation they chose to deal with. One strong characteristic of the U316 course is the problem-solving dimension. At a more educational level, the approach is problem-based, which means that most students' activities involve completing assignments or projects more often than taking tests or exams. Students can choose a project topic that relate directly to them and therefore work methodically at improving their life, effectively, thanks to the learning journey they experience through the course.

In the next section, let us examine how these learning outcomes and skills can help not only in understanding better sustainability, but also potentially being environmentally active.

II.3. Implementation of these learning outcomes and skills in the context of the operationalisation of sustainability

So why is all we have discussed so far relevant in the context of sustainability?
Twenty years ago, or even more, it was highlighted that *the institutional, policy and political, and ideological setting from which solutions to environmental problems will emerge cannot be the same as the one that created these problems in the first place.* In the same way, I now advocate the development of a new form of education, or 'environmental education', that will raise society's awareness to contemporary problems and increase the confidence of any potential stakeholder in taking part in environmental actions.
Understanding sustainability, from conceptual and operational perspectives, requires a fundamental shift in paradigm that can probably best emerge from a shift in the educational system itself.
As explained earlier, new web courses have the ability to not only present environmental issues from different perspectives (and help students understand the evolving characteristics of a concept such as sustainability) but also to develop learning outcomes and skills that are crucially needed when intending to 'participate' in environmental debate, increase one's awareness, develop a critical and analytical mind, and be able to collaborate with other stakeholders through environmental actions.
The various points below summarises how the two courses we have examined might have helped students in understanding sustainability issues better, from a conceptual and a ore operational dimensions.

Students ought to have learned
- various disciplinary dimensions of a same environmental issue;
- to de-mystified certain issues (animation tools and other web activities helped presenting scientific information, or environmental modelling, in an understandable, accessible by all, way, for instance);
- to be aware of the fact that environmental information is changing rapidly and that environmental debates contains some elements of uncertainty that need to be dealt with;
- to appreciate the inter-relations between various environmental and non-environmental issues - i.e. the systemic dimensions of environmental issues;
- to know how to ask questions to oneself and to others;
- to know how to identify/ recognise/ describe/ represent an environmental problem;
- to know how to represent environmental systems and problems, individually or collectively, in view of communicating with others on it;
- to know how, where and for which purpose to look for environmental information;
- to address the issue of environmental prejudice;
- to collaborate, negotiate, agree or disagree;
- how to address conflicts;
- to inform oneself and be aware of various environmental options and constraints;
- the importance of empowering non-experts, and of valuing their views.

Such a set of learning outcomes and skills is of prime importance for creating a more environmental aware and active modern society.
It is also noticeable that certain learning platforms will empower the learner more than others and that learning can become much more action focus through pedagogical approaches such as 'engagement theories'.

In the next and last section, I will examine the learning processes that are taking place amongst 'new web teachers', when developing new methods of teaching and learning in environmental education.

Part 3. Web environmental courses and new pedagogical dimensions

In this part, we will focus and conclude on why it is relevant to question the role of the 'teacher' in the context of environmental education and how it is possible to change the teachers' approach to environmental education.

Key words: Alternatives to the transfer of information; empowerment of the learner; Exchanges of knowledge and experiences: questioning who the 'expert is'; teachers and facilitators; supported and open learning in the context of web courses; taking account of disabilities; social learning amongst the production team

III.1. The characteristics of online teaching

In the context of a web course, the teacher's job changes: the position of 'transferor of knowledge' and 'performer', often associated to the teacher's job, is replaced by that of a facilitator mainly. 'Facilitators', or 'moderators' encourage students to participate in discussions forum and conferences and guide them through their learning journey. Instead of presenting a set of theories or ideas, that would be traditionally considered as the message of the lesson, the facilitator provides information and guidance that will help the students in their web activities, suggest ideas or strategies that will help students pursue their work, and get students to reflect on their work. In other words, the facilitator ensures that the learning outcomes emerge from students' experience and participation, rather than being provided to them.
This implies that the workload is big for the teacher! Not only she/he must ensure that interactivity and participation is taking place within the community of learners - by being involved in the interactive activity too her/himself -, but she/he also must provide some feedback to the students on all their responses to web activities. Peer evaluation can be an alternative. Using FAQs and automatic answers can also save some of the moderators' time. But giving feedback is always absolutely crucial and will motivate students to participate.

In order to respect fully her/students needs, the production team responsible for the creation of a web course must also take account of various types of **disabilities.** Legally, universities that are developing web courses must take account of potential problems with screen readability and typing capabilities, that senior citizens or other learners might encounter. Most software can now compensate for these problems. For those with more severe disabilities such as deafness, blindness, or even autism, multiple sclerosis, or cerebral palsy, a wide range of software is now available[14].

The increase of tasks, from the teacher's point of view, seems to be huge! In fact, one has to bear in mind that the term 'teacher', in the context of a web course, includes people like the academic authors of the course as well as the technicians (web designers, design studios, help desk…), as well as the associate lecturers (or moderators) who actually monitor activities such as web tutorials. However, even if the task is being shared, it does not affect the fact that the teaching itself is designed in a completely different way and that the authors must think differently about the learning journey their students will be going through. In particular, the emphasis on the 'engagement theory' will focus on students learning by doing instead of being told that X is important for reason Z. The author of the course must therefore start the teaching/learning dialogue at the stage of the activities instead of considering the activities as a mere illustration of what has been previously already demonstrated.
By doing so, the teachers and production team are in fact entering the social learning process on teaching and learning and re-thinking educational processes.

At the level of the community of teachers, the various people with their various skills have to learn from each other: an author cannot envisage designing the teaching/learning journey taking place through a web activity if he/she has no idea of what a web activity could consist of. This learning process, or exchanges of professional skills, is a difficult exercise. Delegating a task to another member of the team becomes impossible, as both persons need to work *together* on designing an activity (for instance). At the level of the Open University, this often translates in a long production period, frequent mild panics, but also an enormous amount of collaboration at the team level!

At the broader level, that of a whole university, or even of a network of universities, the experience of designing a web course becomes fascinating: collaboration can take place relatively easily between the different components of the network, all strong on some issues than the others in the network are not. Various perspectives on web teaching can also be shared and implemented. Another way of opening the circle of people involved in the design and 'presentation' of a web course is to have 'guest participants' for a specific class or course topic.

For a lecturer, developing his or her lecturer on his/her own becomes impossible - unless multi-talented and skilled in web designed, animation and programming on top of being knowledgeable about the issue being taught. Instead, not only lecturers share their views more on an issue amongst themselves (in the context of a whole co-authored course, for instance), but they also have to open themselves to the way in which the rest of the team (the non academics) perceive, like, understand, what is being communicated, and suggest alternative ways of doing so. The task of the academic is therefore, to some extent, changing, and so is that of the non academic members of the production team. A real social learning process at work!

In the next section, I will share with you what the production teams learned in the context of the design of both environmental courses.

III.2. The design of the environmental systems teaching module and of the Environmental web course.

[14] http://www.trace.wisc.edu

Teaching to learn on the web

In both courses, teaching how to work on the web was a priority. In both, the guidance given in each web activity was designed very meticulously. In addition, some help was provided during the course (help desk, help from the Associate Lecturers) but some was also provided right at the beginning of the course, although in different ways. Thus, in T205, a course guide was written and produced as a hard copy, a leaflet, with instructions on how to work on the web and how to juggle between the various types of material provided through the course (video, text, web, audio cassettes, etc.). Some people seem to argue that providing a hard copy at the beginning of the course is very helpful to the students who feel comfortable with what is effectively a mini book and might feel that it represents a smoother transition to the web course itself. In general, students appreciate having a hard copy as a help that they can refer to at whatever time. Although the course guide to U316 will also be printed, the core of how to learn on the web will be done through the web. In fact, a special set of lessons on such issues was organised by the Open University[15] and the whole web learning training part of the course will therefore effectively be 'imported' from another part of the university.

Social learning - the production team's perspective. Questioning the notion of experts and teachers.

The authors of the T205 course learned from what the ALs commented on, themselves informed by the students reactions to the course. Occasionally, the students contacted the authors directly.

Within the production team of a web course, as explained earlier, the variety of 'stakeholders' was, in itself, impressive. Academic authors had to learn from, and be supported by, web technicians in their design of the course and of the learning journey. In order to 'teach' things differently using web activities, authors had to be first aware of what *could* be done, without being web technicians themselves. Editors, used to deal with the well-known thick printed OU courses, had to adapt to new requirements needed for the production of a web course. Design studios experts had to learn how to use animation packages in view of improving the ones designed by the authors, themselves initiated to these kinds of technology. An awful lot of learning therefore occurred, both in T205 and in U316, both from a technical and a pedagogical dimensions, and the two are necessarily inter-twinkled if the outcome is to be a good web course. Links to other courses also suddenly appeared more clearly, allowing more co-operation between faculties at the OU level.

During the production of the course, both critical reading processes and quality assessment exercises had to take place, often affecting the timing of the production. After producing T205, we all had learned that this timing was indeed quite different from the production of another course. A web course is not 'a course put on the web'. Rather, it requires the whole production team to think differently about how to design the learning experience and to be prepared for a learning experience themselves.

CONCLUSION

If the social dimensions of sustainability are to be valued, let us start valuing them in the way in which we 'teach sustainability' and environmental issues. Since 'participatory processes', stakeholders' involvement in environmental debates and evaluation exercises, and empowerment of non-experts are given more and more importance, let us highlight them more in our environmental courses.

The fact that the Open University student audience is so broad and varied, and that engagement theories prevail in OU courses, helped me in questioning any distinction between the 'stakeholders' environmental courses focus on and our 'students'. I do wish that the way in which students learn how to collaborate over the web and learn about environmental debates by focusing on some interactive activities will one day extend to a larger community of stakeholders, society itself[16]. Already, students are far from being the only 'learners' in web courses. As explained earlier, the whole production team of the OU course we focused on in this chapter went through a social learning process themselves. Beside, when using the web as a source of information and as a platform for communication, other stakeholders can take part in the social learning process.

The notion of environmental education (of education in general, indeed) is therefore evolving, with the implementation of new technologies. I view this change as very promising since it enables learners to learn from

[15] It is called SAFARI - Skills for Assessing, Finding and Reviewing Information. It is open to the general public at: http://sorbus.open.ac.uk/safari/signpostframe.htm and can also be found from the Open University web site through a standard search.

[16] Note that many research projects are now focusing on such issues, including a European research project that the author is involved in herself, called Virtu@lis ("Social Learning on environmental issues with interactive information and communication technologies" - No. IST-2000-28121 - co-ordinated by Prof. Martin O'Connor, Universite de Saint Quentin en Yvelines, C3ED, France.

different sources, to realise that they can benefit from doing so, and to progressively build bridges between learning and doing.
Despite the difficulties in creating successful web courses, and taking account of the fact that we are still learning how to do this best, I feel that we can afford to hope that web environmental education will convincingly help a variety of stakeholders all over the world in being more aware and involved in environmental action and in operationalising sustainability.

ANNEXE - adapted from Kearsley, G. (2000)

Themes that shape online education:

Collaboration: can happen among students and also can include teachers
Connectivity: Students can easily connect with other students, instructors, teachers, even experts.
Student-centeredness: Students must accept more self-responsibility for their learning and are invited to express their view and share their knowledge and experience. The notion of 'expert' on an issue is thus being questioned.
Unboundedness: Online education eliminates the walls of the classroom: it gives students access to information and people anywhere in the world.
Community: Education and the learning process takes place in a community, whether it is the community of learning defined by a particular school or college, or a physical community such as a town or a city. Online education can bring together any community by increasing accessibility and connectivity. This notion is very much related to the notion of 'social learning'.
Exploration: Many on-line activities involve some sort of adventure or discovery learning format. A more formal type of exploration is problem-based learning - which is very compatible with online education because access to resources and expertise is a key aspect of problem solving.
Shared knowledge: Putting information on the web makes it immediately available to anyone in the world with a suitable computer connection. Students can tap into a vast shared knowledge network and they can contribute to it as well: the web does not distinguish between documents created by Nobel laureates and 5th graders; what matters is the quality and usefulness of the information provided.
Multi-sensory experience: Learning is more effective when it involves multiple sensory channels (visuals, colour, movement, sounds…). Multi media technology provides certain kinds of multi-sensory learning experiences.
Authenticity: Because students can access actual databases and experts, their learning activities are realistic. - One of the reasons that students often give for disillusionment with school or college is that it lacks 'real world relevance'.

Elements of online education

The opportunities to create new types of learning communities are numerous in web courses. This can be done through:

Email:
In most cases, the response is sent as a private message to the instructor, who then provides feedback directly to the student via a reply. It is also possible to make this process more public by having students send copies of their responses to other students or having instructors circulate feedbacks in the same way. Important psychological factor: students know that if they want to ask the instructor a question or need help with a course-related problem, they can do so.
Threaded discussions:
-also called asynchronous conferencing, forum, or bulletin board. Topics and sub-topics are created, and people post messages under any topic/ sub-topic desired. Everyone sees all the responses. All messages remain on the system.
Real time conferencing:
(online synchronous interaction). The simplest form is a chat session, in which participants exchange typed messages and everyone sees the messages as soon as they are sent. Because the interaction is in real time, it is spontaneous and dynamic. Once a chat session has more than three or four participants, it is desirable to have a moderator who controls when people 'speak'. Most chat systems provide a save feature that allows the entire session to be saved as a file, which makes it possible to review the discussion later.
MUDs (Multi-user domain) and MOOs (MUDs object orientated):
Real time conferences. They allow people to share a virtual world, usually set up as 'rooms' containing objects that can be viewed or manipulated. People can interact with others by sending chat messages as well as performing simulated actions. MUDs and MOOs have been used in various ways for education. For instance, it is possible to develop a MUD/MOO for a specific subject area (for example historical events, cell biology…) in which 'rooms'

correspond to major concepts and contain elements relating to those concepts. E-MOO is a site dedicated to the use of MUDs and MOOs in education (http://tecfa.unige.ch:4243)

Desktop video:

It is a chat system that uses video images instead of text messages. The video images are captured by a small digital camera that is connected to the PC. How many people can be linked up at once depends on many factors - the primary one being the bandwidth (transmission capacity) of the connections involved. Many desktop video conferencing programs are available; CU-SeeMe is one of the oldest and most commonly used (see http://www.cuseeme.com). It can handle to twelve participants.

Audiographics

These systems allow audio interaction and shared graphic images or applications. Participants in the conference can hear what the others say and see the same graphic images or program screens. The graphic images can be slides prepared with a slideshow program, or can be drawn in real time on the screen by any of the participants (hence the system is often called shared whiteboard). Alternatively, an application program running on one participant's system can be seen by all participants and, in most cases, controlled by anyone participating.

Audiographic systems require much less bandwidth and machine capability than videoconferencing.

Groupware

Relatively new category of software specifically designed to facilitate group interactions. Lotus Notes, currently the most widely used GroupWare program, is popular in many organisations and university programs. For example, Athabasca university in Canada uses it as the basis for students interaction in its MBA program (see http://vital.athabascau.ca). The primary focus of most GroupWare is on problem-solving and decision-making tasks, including such activities as brainstorming, poll-taking, prioritisation, and negotiation. All participants work on a common task. A list of possibilities is generated based on input from each participant. Once a list is generated, all participants prioritise the items by ranking or rating them. The prioritised list is then shown to all, and discussion ensues. Many variations are possible.

File transfers

A mundane but nonetheless essential aspect of online interactions is file transfer - sending a file from one machine to another. I most cases, the file to be transferred is a word processing document, but it could be a spreadsheet, graphic, video clip, slideshow, or program.

The general purpose tool for transferring files is a utility program called FTP (File Transfer Program). To use an FTP program, you provide the server address for the machine you want to transfer the file to and then type in a valid user name and password. You then select the directory and folder you want to upload to or download a file from. To use FTP, you must have access to an account on the networked system unless there is a 'public' account, called 'anonymous FTP', that has no password and is used solely for file transfers. In any event, you must know the server address (for example public.wadworth.com) to make the connection.

Beware, one of the technical complications of file transfer is differences in file formats.

Application software:

Up to this point, we have been discussing software exclusively concerned with networking. However, much of the work in online education is done with routine application programs such as word processing, spreadsheets, graphic editors, and presentation software that are used to create instructional materials or do course assignment. Almost every discipline has a variety of programs designed for certain teaching/ learning activities. Some of these programs have been personally developed by instructors for their own courses. The main consideration in using application programs in any course is how and when students will learn to use the software. Teachers and schools have developed a number of strategies to handle this dilemma. One is to require completion of a prerequisite course teaching the relevant software prior to enrolment in class that involves its use. Many colleges offer a computer literacy course that covers basic application programs.

Simulations

Simulations are based on a model of a specific system-mechanical, electronic, chemical, industrial, biological or social. The student is presented with a system state that provides a number of choices; the choice made determines the next state of the system.

Not only do simulations provide effective learning opportunities, but they can also be fun - when put in the form of simulation games. A good example are the simulation games developed by Maxis Corporation, which began as entertainment but have become widely used for educational purposes (see http://www.maxis.com)

Because simulations are so media intensive, they tend to be expensive and time consuming to develop, which is one reason why their availability and use is limited. Furthermore, simulations are usually very interactive and require a lot of computing resources - systems with fast processors, ample memory, and a lot of network bandwidth.

Curriculum development and management

A large collection of programs is available to develop and manage online instructions. Many authoring tools are available for the creation of web pages and sites (e.g. Front Page, Web-in-a-box). Such tools make it relatively easy to assemble different kinds of information into a web page and put it into HTML format. Comparisons and discussions of web-based learning systems are provided at http://www.ctt.bc.ca/landonline/choices.html and http://cleo.murdoch.edu.au/asu/edtech/webtools/compare.html

References:

Alexander, G. (1998) "Communication and collaboration online: New course models at the open university", presented at the Networked Life-long Learning Conference, Sheffield University, Sheffield, 20 - 22 April, 1998.

Clayton, A.M.H. and N. Radcliffe (1997) Sustainability; a systems approach. Earthscan, London.

Daniels, S.E. and Walker, G.B. (1996) Collaborative learning: improving public deliberation in ecosystem-based management. Environmental impact assessment review, 16: 71-102

European Union (1998) Towards sustainable water resources management. EU, Directorate general for development, and DG for external relations and north-south co-operation. Luxembourg

Ewing, J. M., J.D.Dowling and N. Coutts (1998) Teaching thinking IS possible through information and Communication Technologies. Virtual university Journal, 1,3, 127-141.

Ewing, J. M., J.D.Dowling and N. Coutts (1999) Learning using the World Wide Web: a collaborative learning event. Journal of Educational Multimedia and hypermedia, 8, 1, 3-22.

Hoekstra, A.Y. (1998) Perspectives on water. An integrated model-based exploration of the future. International books, Utrecht, The Netherlands.

Jiggins J. and Roling, N. (1999) " Interactive valuation: the social construction of the value of ecological services". International Journal of Environment and Pollution, Volume 12, No.4.

Kearsley, G. (2000) Online education. Learning and teaching in cyberspace. Wadsworth, Belmont.

McConnell, D. (2000) (2nd edition) Implementing computer supported co-operative learning. Kogan page, London.

McVay, M. (2000) (2nd edition) How to be a successful distance learning student. Learning on the internet. Pearson Custom publishing.

Miller, R. (2000) Creating learning communities. A project of the Coalition for self learning. A Solomon Press book, The foundation for educational renewal, Brandon.

O'Connor, M. (2001) Our common problem. Cahier du C3ED, Universite de Saint Quentin en Yvelines, Paris.

Van Lieshout, M. et al (eds) (2001) Social learning technologies. The introduction of multimedia in education. Ashgate publishing, Aldershot.